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AMENDED APPEAL BRIEF TRANSMITTAL FORM

First Named Inventor	Alex S. Toback
Title	Connection System for Steel Construction
Serial No.	09/639,599
Filing Date	August 16, 2000
Examiner	Essama Omgba
Group Art Unit	3726
Attorney Docket Number	TOB/102/US
Date	June 5, 2006

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Trademark Office
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Alexandria, Virginia 22313-1450

Honorable Sir:

TRANSMITTAL OF AMENDED APPEAL BRIEF
(PATENT APPLICATION - 37 C.F.R. § 1.192(a))

1) Transmitted herewith, in triplicate, is the Appeal Brief in this application with respect to the Notification of Non-Compliant Appeal Brief dated April 4, 2006.

2) STATUS OF APPLICANT: This application is on behalf of:

☐ Large Entity
☒ Small Entity

3) FEE FOR FILING APPEAL BRIEF

PURSUANT TO 37 C.F.R. §1.17(c), the fee for filing the Appeal Brief is:

☐ Large Entity $500.00
☒ Small Entity $250.00 (Previously Paid)

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4) EXTENSION OF TIME

It is hereby petitioned that any required extension of time be granted for filing the Appeal Brief. An extension of 1 month(s) having a fee of $ 60.00 appears required.

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited on the date below with the United States Postal Service as first class mail in an envelope addressed to "Mail Stop Appeal Brief-Patents, Commissioner for Patents, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, Virginia 22313-1450."

Typed or Printed Name: Guy D. Yale — Reg. No. 29,125
Signature: — Date: June 5, 2006

First Named Inventor	Title	Attorney Docket Number
Alex S. Toback	Connection System for Steel Construction	TOB/102/US

5) TOTAL FEE DUE

APPEAL BRIEF DUE: $ 0.00

EXTENSION FEE DUE: $ 60.00

TOTAL FEE DUE: $ 60.00

6) FEE PAYMENT

☒ Attached is a check in the amount of: $ 60.00

7) FEE DEFICIENCY

☒ If any additional extension and/or fee is required, this is a request therefor and the Commissioner is authorized to charge Deposit Account No. 16-2563, and/or if there is any overpayment, the Commissioner is authorized to credit any overpayment to Deposit Account No. 16-2563. *A duplicate copy of this sheet is enclosed.*

Respectfully Submitted,

Alex S. Toback

By: _____

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	09/639,599
Applicant	:	Alex S. Toback
Filing Date	:	August 16, 2000
Title	:	Connection System for Steel Construction
TC/A.U.	:	3726
Examiner	:	Essama Omgba
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Customer No.	:	002543

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Honorable Sir:

AMENDED APPEAL BRIEF

This brief contains the following sections under the headings and in the order set forth below as required by 37 C.F.R. 41.37(c)(1) and MPEP 1205:

I. REAL PARTY IN INTEREST

II. RELATED APPEALS AND INTERFERENCES

III. STATUS OF CLAIMS

IV. STATUS OF AMENDMENTS

V. SUMMARY OF CLAIMED SUBJECT MATTER

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

VII. **ARGUMENT**

VIII. **CONCLUSION**

IX. **APPENDICES**

APPENDIX A CLAIMS INVOLVED IN THE APPEAL

APPENDIX B DECLARATION OF ALEX S. TOBACK

The final page of Section VIII bears the signature of Appellant's attorney.

I. REAL PARTY IN INTEREST

The real party in interest is the inventor/applicant Alex S. Toback.

II. RELATED APPEALS AND INTERFERENCES

Appeal No. 2004-2329 is related to this application.

There are no known interferences or judicial proceedings related to this application.

III. STATUS OF CLAIMS

a STATEMENT OF STATUS OF ALL CLAIMS IN THIS PROCEEDING

CLAIMS 1-24 ARE PENDING IN THE APPLICATION.

CLAIMS 1-24 ARE REJECTED IN THE APPLICATION.

b CLAIMS ON APPEAL

THE CLAIMS ON APPEAL ARE CLAIMS 1-24.

IV. STATUS OF AMENDMENT

Appellant has submitted no amendments subsequent to the final rejection dated July 21, 2005.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Briefly stated, claim 1 is directed to a connection system with enhanced load bearing capacity for connecting light-gauge steel panels to a support structure (Figure 1(b) and page 1, lines 14-16). The connection system is comprised of an adhesive **10**, which is applied to at least one side of a light-gauge panel **30**, and fasteners **20** (Figure 1(b), Figure 8, and page 2, lines 32-33). The fasteners employed in the inventive connection system may take a wide

variety of forms including a self-drilling metal panel fastener which is the subject of U.S. Patent No. 5,304,023 as well as other self-drilling screws, pins, rivets, and clinches (page 1, lines 19-20). The panel is then placed against a support structure (stud **40**) and fasteners **20** are inserted through the panel and support structure (Figure 8 and page 3, lines 16-20). The adhesive is then allowed to cure (page 3, lines 23-24). The adhesive is a two-part epoxy system having a substantially 1:1 resin/hardener mix by weight or volume which has a high viscosity and fully cures at room temperature within 72 hours (page 3, lines 7-12). One acceptable adhesive employed in the inventive connection system is Formulation No.12059A marketed by the Advanced Adhesive Systems of Newington, Connecticut (page 3, lines 8-10). Other acceptable adhesives may be heat-activated materials such as methacrylate and urethane (page 3, lines 13-15). By employing both adhesive and fasteners to light-gauge steel panel connections, the connection system of claim 1 dramatically reduces the number of fasteners required while also enhancing the load bearing capacity and integrity of the connection (page 2, lines 32-34).

Briefly stated, claim 8 is directed to a connection system for connecting at least one light-gauge steel member **30** to a second light-gauge steel member **40** by applying a bead of epoxy **32** and/or **42** to one or both of the steel surfaces (Figure 8, and page 3, lines 16-24). The first light-gauge member **30** is then placed in an overlapping relationship against the second member **40** and fasteners **20** are then inserted through the first member and into the second member by power driver **24** (Figure 8, and page 3, lines 16-24). The fasteners employed in the inventive connection system may take a wide variety of forms including a self-drilling metal panel fastener which is the subject of U.S. Patent No. 5,304,023 as well as other self-drilling screws, pins, rivets, and/or clinches (page 1, lines 19-20, and page 3, lines 21-23). The epoxy **32**, **42** is compressed between the first **30** and second member **40** (Figure 8, and page 3, lines 16-24). The epoxy is allowed to cure (page 3, lines 23-24). The epoxy is a two-part epoxy system having a substantially 1:1 resin/hardener mix by weight or volume which has a high viscosity and fully cures at room temperature within 72 hours

(page 3, lines 7-12). One acceptable adhesive employed in the inventive connection system is Formulation No.12059A marketed by the Advanced Adhesive Systems of Newington, Connecticut (page 3, lines 8-10). Other acceptable adhesives may be heat-activated materials such as methacrylate and urethane (page 3, lines 13-15).

Briefly stated claim 16 is directed to a connection system for connecting at least one light-gauge steel panel **30** to a steel frame member, stud **40**, by applying a bead of epoxy **32** and/or **42** to one or both of the steel surfaces (Figure 8, and page 3, lines 16-24). The inventive connection system may be used with a number of different support structures, such as steel and metal studs, non-metallic studs, framing, FRP plastics panel, and plywood panel (page 4, lines 30-32). The first light-gauge steel panel **30** is then placed in an overlapping relationship against stud **40** and fasteners **20** are then inserted through the light-gauge panel **30** and into the stud **40** by power driver **24** (Figure 8, and page 3, lines 16-24). The fasteners employed in the inventive connection system may take a wide variety of forms including a self-drilling metal panel fastener which is the subject of U.S. Patent No. 5,304,023 as well as other self-drilling screws, pins, rivets, and/or clinches (page 1, lines 19-20, and page 3, lines 21-23). The epoxy **32**, **42** is compressed between the first **30** and second member **40** (Figure 8, and page 3, lines 16-24). The epoxy is allowed to cure (page 3, lines 23-24). The epoxy is a two-part epoxy system having a substantially 1:1 resin/hardener mix by weight or volume which has a high viscosity and fully cures at room temperature within 72 hours (page 3, lines 7-12). One acceptable adhesive employed in the inventive connection system is Formulation No.12059A marketed by the Advanced Adhesive Systems of Newington, Connecticut (page 3, lines 8-10). Other acceptable adhesives may be heat-activated materials such as methacrylate and urethane (page 3, lines 13-15).

Briefly stated, claim 19 is directed to an assembly that is comprised of a support structure, a panel of light-gauge steel mounted to the support structure with a structural adhesive disposed between and at least one fastener driven

through the panel and into the support structure (Figure 8, and page 3, lines 16-20). The fasteners employed in the inventive assembly may take a wide variety of forms including a self-drilling metal panel fastener which is the subject of U.S. Patent No. 5,304,023 as well as other self-drilling screws, pins, rivets, and/or clinches (page 1, lines 19-20, and page 3, lines 21-23). The epoxy is a two-part epoxy system having a substantially 1:1 resin/hardener mix by weight or volume which has a high viscosity and fully cures at room temperature within 72 hours (page 3, lines 7-12). One acceptable adhesive employed in the inventive connection system is Formulation No.12059A marketed by the Advanced Adhesive Systems of Newington, Connecticut (page 3, lines 8-10). Other acceptable adhesives may be heat-activated materials such as methacrylate and urethane (page 3, lines 13-15). By employing both adhesive and fasteners, the inventive assembly of claim 19 dramatically reduces the number of fasteners required while also enhancing the load bearing capacity and integrity of the connection (page 2, lines 32-34).

The superior results of the inventive assembly of claim 19 is demonstrated by the hysteresis curves of Figures 4-7. The superior connection of the inventive assembly is essentially provided by the structural adhesive as opposed to the mechanical fasteners (page 4, lines 10-14, and page 5, lines 7-9). Further documentation as to the superior connection of the assembly of claim 19 is shown through laboratory tests of overlapping lap joint specimens with various numbers of fasteners in combination with the adhesive system (Figure 3).

Briefly stated, claim 22 is directed to an assembly comprising a metal support frame, a panel of light-gauge steel mounted to the support frame, with a structural adhesive disposed in between, and at least one fastener driven through the panel and into the metal support frame (Figure 8, and page 3, lines 16-20). The fasteners employed in the inventive assembly may take a wide variety of forms including a self-drilling metal panel fastener which is the subject of U.S. Patent No. 5,304,023 as well as other self-drilling screws, pins, rivets, and/or clinches (page 1, lines 19-20, and page 3, lines 21-23). The epoxy is a two-part epoxy system having a substantially 1:1 resin/hardener mix by weight or

volume which has a high viscosity and fully cures at room temperature within 72 hours (page 3, lines 7-12). One acceptable adhesive employed in the inventive connection system is Formulation No.12059A marketed by the Advanced Adhesive Systems of Newington, Connecticut (page 3, lines 8-10). Other acceptable adhesives may be heat-activated materials such as methacrylate and urethane (page 3, lines 13-15). By employing both adhesive and fasteners, the inventive assembly of claim 22 dramatically reduces the number of fasteners required while also enhancing the load bearing capacity and integrity of the connection (page 2, lines 32-34).

The superior results of the inventive assembly of claim 22 is demonstrated by the hysteresis curves of Figures 4-7. The superior connection of the inventive assembly is essentially provided by the structural adhesive as opposed to the mechanical fasteners (page 4, lines 10-14, and page 5, lines 7-9). Further documentation as to the superior connection of the assembly of claim 22 is shown through laboratory tests of overlapping lap joint specimens with various numbers of fasteners in combination with the adhesive system (Figure 3).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

(1) Claims 1-24 stand rejected under 35 U.S.C. §103(a) over Applicant's Admitted Prior Art (AAPA) in view of Orowan (U.S. Patent No. 3,655,424).

(2) Claims 4-7 stand rejected 35 U.S.C. §103(a) over AAPA/Orowan as applied to claim 1 in further in view of Good, et al (U.S. Patent No. 4,426,425).

(3) Claims 8-15 stand rejected under 35 U.S.C. §103(a) over AAPA in view of Orowan and Good, et al.

(4) Claims 18, 21 and 24 stand rejected under 35 U.S.C. §103(a) over AAPA/Orowan as applied to claims 16, 19 and 22 and further in view of Good, et al.

VII. ARGUMENT

(1) THE REJECTION OF CLAIMS 1-24 UNDER 35 U.S.C. § 103(A) OVER APPLICANT'S ADMITTED PRIOR ART (AAPA) IN VIEW OF OROWAN (U.S. PATENT NO. 3,655,424).

A. THE EXAMINER HAS NOT PROPERLY APPLIED THE LEGAL REQUIREMENTS FOR A REJECTION UNDER 35 U.S.C. § 103

In determining the differences between the prior art and the claims, the question under 35 U.S.C. §103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. Stratoflex. Inc. v. Aeroquip Corp., 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983); Carl Schenck. A. G. v. Nortron Corp., 713 F.2d 782, 218 USPQ 698 (Fed. Cir. 1983). Furthermore, "a patentable invention may lie in the discovery of the source of a problem even though the remedy may be obvious once the source of the problem is identified. This is part of the 'subject matter as a whole' which should always be considered in determining the obviousness of an invention under 35 U.S.C. 103". In re Sponnoble, 405 F.2d 578,585,160 USPQ 237,243 (CCPA 1969).

The Examiner Has The Burden Of Establishing A *Prima Facie* Case Of Obviousness Within The Legal Requirements Created By The Courts.

The courts have further established the legal concepts of *prima facie* obviousness. As summarized in MPEP §2142, "the legal concept of *prima facie* obviousness is a procedural tool of examination which . . . allocates who has the burden of going forward with the production of evidence in each step of the examination process." The MPEP further states "the Examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. If the Examiner does not produce a *prima facie* case, the Applicant is under no obligation to submit evidence of nonobviousness."

To establish a *prima facie* case of obviousness three basic criteria must be met. First, there must some suggestion or motivation, either in the references

themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. See MPEP §2143.

When the issue is obviousness, the Federal Circuit has recently stated:

> "The need for specificity pervades this authority. See, e.g., In re Kotzab, 217 F.3d 1365, 1371, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) ("particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed").
> In re Rouffet, 149 F.3d 1350, 1359,47 USPQ2d 1453, 1459 (Fed. Cir. 1998) ("even when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill, that suggests the claimed combination. In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious."). In re Fritch, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992) (the Examiner can satisfy the burden of showing obviousness of the combination "only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references"). In re Lee, 61 USPQ2d at 1433-1434.

Ample Legal Authority To Support The Conclusion That The Examiner Has Failed To Establish A *Prima Facie* Case Of Obviousness Against Appellant's Pending Claims.

The burden is on the Examiner to demonstrate that the prior art evidence is sufficient suggestion of the desirability of doing what the inventor has done. (See MPEP §2142.). At an irreducible minimum, this burden requires the Examiner to apply the facts of the case to "present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references." A showing of a suggestion, teaching or motivation to combine the prior art reference is an "essential component of an obvious holding" C.R. Bard. Inc., v. M3 Systems, Inc., 48 USPQ2d 1225,1232 (Fed. Cir. 1998).

The Examiner has clearly not shown why a skilled artisan, with no knowledge of the claimed invention, would have arrived at the Appellant's claimed invention. This is improper. See, e.g., In re Lee at 1433, citing to In re Kotzab, at 1317 (Fed. Cir. 2000); See In re Dance, 160 F.3d at 1343, 48 USPQ2d at 1637 (Fed. Cir. 1998) ("there must be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the Applicant").

Obviousness does not require absolute predictability, however, at least some degree of predictability is required. Evidence showing there was no reasonable expectation of success may provide a conclusion of nonobviousness. See MPEP §2143.02 citing In re Reinhart, 189 USPQ 143 (CCPA 1976). The courts have held that for obviousness under 35 U.S.C. §103, there must have been a reasonable expectation of success for the modification proposed by the Examiner. In re O'Farrell, 853 F.2d 894, 903-904, 7 USPQ2d 1673, 1680-1681 (Fed. Cir. 1988). The expectation of success is not whether it would have been obvious to try a modification or combination. Gillette Co. v. S.C. Johnson & Son, Inc., 191 F.2d 720, 725, USPQ2d, 1923, 1927 (Fed. Cir. 1990).

The courts have stated the Examiner cannot discharge himself from the burden of showing all the claimed elements by simply declaring all of the elements of an invention, along with the manner of combining these elements, to be well known in the art. Ex parte Stern, 13 USPQ2d 1379, 1381 (Bd. Pat. App. & Inter. 1989).

The Examiner Has Resorted To Impermissible Hindsight To Assert That Appellant's Claims Are Obvious Over The Cited References.

35 U.S.C. §103 specifies that the obviousness of an invention is to be determined as of "the time the invention was made." This requires the Examiner to step backward in time and into the shoes worn by the hypothetical person of ordinary skill in the art when the invention was unknown and just before it was made. See MPEP §2142. "When applying 35 U.S.C. §103, . . . the references must be viewed without the benefit of impermissible hindsight vision afforded by

the claimed invention . . . " Hodosh v. Block Drug Co., Incl., 229 USPQ 182, 187, N5 (Fed. Cir. 1986); W.L. Gore & Assocs., Inc. v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303,312-13 (Fed. Cir. 1983) ("To imbue one of ordinary skill in the art with knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher."); In re Gorman, 933 F.2d 982, 986, 18 USPQ2d 1885, 1888 (Fed.Cir.1991)(It is the prior art itself, and not the applicant's achievement that must establish the obviousness of the combination. Obviousness cannot be established by hindsight combination to produce the claimed invention).

B. CONTEXT OF APPELLANT'S CLAIMS NOT FULLY APPRECIATED BY EXAMINER.

The invention of the claims under appeal embrace a seminal development in the light gauge steel construction industry, namely, the use of adhesives in construction involving light gauge steel. As a predicate to consideration of the claims and the rejections, it is very apparent that there are technical subtleties with respect to the disclosed and claimed invention and with respect to the alleged prior art, which may not be readily appreciated. Appellant's invention and the art as cited by the Examiner are from wholly different eras with respect to adhesion technology and are also from wholly different technological fields. In this regard, it should be appreciated that many of the terms and descriptions employed in the cited art and Appellant's claimed invention have significantly different contexts.

A fundamental understanding of Appellant's invention derives from the field of technology wherein Appellant is joining light gauge metal members within the context of the construction trades by a novel use of adhesives which has not been heretofore achieved, and in fact, was contrary to the prevailing technology at the time of the invention. In Appellant's invention, once the joining process is completed, the principal portion of the joint load-bearing capacity (as contrasted

to the cited art) is provided by the adhesive, and not the mechanical fasteners, as recited in the claim 8 representative feature so that members are joined in a connection which is significantly enhanced in load-bearing capacity to the connection provided only by the at least one fastener. The remaining independent claims 1, 16, 19 and 22 recite analogous features in relation to joined elements. Appellant has further documented this novel load-bearing feature in the specification as well as schematically and quantitatively illustrated the same in the figures of the application. The significantly enhanced load-bearing feature provided by Appellant's fastening system is documented by the hysteresis curves of Figures 4-7. When the Orowan '424 reference is properly considered as a whole, a fair inference is that the Orowan fasteners provide the most significant load-bearing factor to the analogously joined assembly. Indeed, the Orowan adhesive functions to enhance the connecting integrity of the mechanical fasteners.

Moreover, the Declaration of Alex S. Toback provides further evidence that there is no basis or suggestion whatsoever that a person of ordinary skill in the art in the light gauge steel construction industry at the time of the invention would have considered adhesives or turn to the Orowan reference in connection with fastening light gauge steel panels to a support structure. A copy of the Declaration submitted to the Examiner on February 8, 2005 is included as an Appendix and is hereinafter referred to as "Declaration".

As explicitly set out in paragraphs 8 and 9 of the Declaration, the problem posed to the inventor was not the relief of load on the fasteners or fretting of the fasteners as ascribed by the Examiner, but the labor-intensive nature of light gauge steel construction. In this regard, when the Orowan reference is considered as a whole, it does not disclose a technical solution that reduces the labor or expense of light gauge steel construction. Rather, Orowan discloses a complicated and relatively expensive adhesive tape structure that is intended to supplement the conventional mechanical fasteners used in fastening metal members together. (See Declaration para. 9) Thus, the Orowan reference does not have the capacity to reduce in the number of fasteners used nor is there any

foreseeable cost saving. Finally, there is no evidence to suggest that the Orowan fastening system substantially enhances the load-bearing capacity as compared to mechanical fasteners alone. (See Declaration, para. 9) This is in direct contrast to Appellant's invention, which reduces the costs and labor demands for assembling light gauge structural panels into a support structure by reducing the number of fasteners required in the process.

Applicant's invention employs the mechanical fasteners to provide a fastening function while the adhesive is curing between the joint members as well as to provide an auxiliary mechanical lock if the joined system should ever be subjected to fire or intense heat which would potentially compromise the integrity of the adhesive bond in a structure which may typically be used for buildings and the like. Indeed, as stated in paragraph 7 of the Declaration, "the light gauge steel construction industry typically must comply with building and fire codes in connection with the integrity of fastening systems." More significantly, there is no proper basis of record to refute the contention that until Appellant had considered using adhesive systems in conjunction with light gauge steel construction elements, there was no thought or suggestion whatsoever in the light gauge steel industry of using chemical or adhesive systems in light gauge steel construction. (Declaration, para. 7) Thus, the Examiner is incorrect in his assessment of what constituted "a person of ordinary skill in the light gauge steel construction industry" at the time the invention was made. (See also Declaration, para. 5)

Moreover, it is highly significant and it is explicitly noted that the Orowan '424 reference represents an approach that was originally tried by Applicant, but the Orowan approach was rejected because it could not provide the requisite load-bearing characteristics. The Orowan '424 reference is clearly concerned with an adhesive tape or adhesive film type adhesion system which Applicant originally considered, but after due testing, rejected the approach since it did not provide sufficient adhesive load-bearing capacity.

It should be appreciated that all of the pending claims of the application incorporate the feature wherein the members (of panel or structure or frame) are

joined in a connection that is significantly enhanced in load-bearing capacity to a connection provided by fasteners alone.

C. THE PROPOSED COMBINATION OF AAPA AND OROWAN IS IMPROPER.

There is no proper basis for the Examiner' s proposed combination of AAPA and Orowan. The rationale advanced by the Examiner is flawed.

The basis for the Examiner's final rejection of claims 1-24 under 35 U.S.C. §103(a) over Applicant's Admitted Prior Art (AAPA) in view of Orowan, U.S. Patent No. 3,655,424 (Orowan) is set forth on page 2 of the Final Action.

The Examiner states as follows:

> 2. Claims 1-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Admitted Prior Art (AAPA) in view of Orowan (US Patent 3,655,424).
>
> With regards to claims 1-3, 8-10, 16, 17, 19, 20, 22 and 23, Applicant, at pages 1 and 3 of the specification to be known as AAPA discloses a connection system for light-gauge steel construction and an assembly wherein numerous self-drilling screws or other fasteners are used to provide the connection between a panel and a support structure. AAPA does not disclose applying an adhesive curable at room temperature to at least the panel or the support structure and placing them against each other. However, it is known to use an adhesive material between plates of a lap joint used in a connection with rivets or other fasteners as attested by Orowan, see column 1, lines 8-30 and figure 1.
>
> Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made, to have used an adhesive material in the connection of AAPA, in light of the teachings of Orowan, in order to relieve the load on the fasteners to a relatively small extend [sic] and give protection against fretting between the parts joined. Applicant should note that the connection of Orowan is significantly enhanced in load-bearing capacity, see column 1, lines 24-29 in particular.

There is no teaching or suggestion whatsoever in the AAPA of the use of an adhesive, nor the use of a second type of connecting of any kind, nor is there any teaching or suggestion that would motivate anyone in any conceivable way to look to an adhesive or any second connecting means.

Appellant's invention was not motivated in any fashion by the mechanical integrity or load-bearing capacity of the fasteners employed in the prior art structures to which Applicant's invention relates. ***Appellant was motivated to provide a connecting system for light-gauge steel which was less labor intensive and which would accordingly be less costly to implement.*** (See also Declaration, para. 7) In the prior art systems to which the invention relates, numerous mechanical fasteners, typically self-drilling screws, were required in order to provide the required load-bearing characteristics for the structure. Adhesives as such were not employed to connect the light-gauge steel panels to the support frames. (See Declaration, para. 7)

The Examiner fully acknowledges that AAPA does not disclose applying an adhesive curable at room temperature to at least the panel or the support structure and placing them against each other. The logic used by the Examiner is wholly misplaced. The Examiner's motivation for the combination appears to be stated as follows:

> However it is known to use an adhesive material between plates of a lap joint used in the connection with rivets or other fasteners is attested by Orowan (see column 1, lines 8-30 and Figure 1).
>
> Therefore it would have been obvious to one of ordinary skill at the time the invention was made, to have used an adhesive material in the connection of AAPA in light of the teachings of Orowan in order to relieve the load on the fasteners to a relatively small extend [sic] and give protection against fretting between the parts joined.

Contrary to the assertions of the Examiner, there was no suggestion whatsoever in AAPA as to any problems with any need to relieve load on the mechanical fasteners, nor were there any problems with fretting given the large numbers of fasteners. Accordingly, there is clearly no proper basis whatsoever for the proposed combination.

D. THE PROPOSED COMBINATIONS FAIL TO DISCLOSE, TEACH OR SUGGEST EACH OF THE CLAIM FEATURES.

The Examiner states that "Applicant should note that the connection of Orowan is significantly enhanced in load-bearing capacity, see column 1, lines 24-29 in particular." (Final Action p.2). Here, the Examiner has failed to appreciate the relevant claim text because Applicant is not concerned with enhancing the load- bearing capacity as such, although it is a certainly surprising result of Applicant's invention. The relevant features of Applicant's claims which are not disclosed in the Orowan (or any other cited reference) reference, recite that the load-bearing capacity of the adhesive is such that the panel is joined to the structure in a connection which significantly enhanced in load-bearing capacity to a connection provided only by the at least one fastener. The Orowan reference is wholly silent with respect to this claim feature. However, it is very clear that in the Orowan reference, the object is to enhance the effectiveness of the mechanical fasteners. The Orowan reference, when properly considered as a whole, unlike Applicant's object to reduce the labor and save cost in the connecting of light-gauge steel panels to frames, actually necessarily complicates the connecting process. There is no elimination of, for example, mechanical fasteners as accomplished in Applicant's invention.

Likewise, the Examiner really sets forth no basis for a reasonable expectation of success were the references combined.

E. SPECIFIC ERRORS OF REJECTION FOR EACH OF THE CLAIMS.

CLAIMS 1-3

Claims 1-3 recite as follows:

1. A connection system for connecting at least one light-gauge steel panel to a support structure comprising:

applying an adhesive to at least one of said panel or support structure, said adhesive being curable at room temperature and able to adhere to steel;

placing said panel against said support structure;

driving at least one fastener through the panel into said support structure; and

allowing said adhesive to cure,

so that said panel is joined to said structure in a connection which is significantly enhanced in load-bearing capacity to a connection provided only by the at least one fastener.

2. The connection system of claim 1 wherein the fastener is selected from the group consisting of self-drilling screws, rivets, pins, and clinches.

3. The connection system of claim 1 wherein each said fastener is a self-drilling screw.

Claims 1-3 have been rejected as unpatentable under 35 U.S.C. §103(a) over AAPA in view of Orowan. The Examiner's rejection of claims 1-3 should be reversed and the claims deemed patentable because there is no proper basis for the proposed combination of AAPA and Orowan and also because the proposed combination does not disclose, teach or suggest a feature wherein "said panel is joined to said structure in a connection which is significantly enhanced in load-bearing capacity to a connection provided only by the at least one fastener".

CLAIMS 16 AND 17

Claims 16 and 17 recite as follows:

16. A connection system for connecting at least one light-gauge steel panel to a steel frame comprising:

applying a bead of adhesive to at least one of said panel or frame, said adhesive being curable at room temperature and able to adhere to steel;

positioning said panel against said frame with said adhesive disposed between said panel and frame;

driving at least one fastener through said panel into said frame; and

allowing said adhesive to cure,

so that said panel is joined to said frame in a connection which is significantly enhanced in load-bearing capacity to a connection provided only by the at least one fastener.

17. The connection system of claim 16 wherein the fastener selected from the group consisting of self-drilling screws, rivets, pins, and clinches.

Claims 16 and 17 have been rejected by the Examiner as being unpatentable over AAPA in view of Orowan. This rejection should be reversed

and the claims be deemed allowable for the reason that there is no proper basis for the proposed combination, and further, the proposed combination fails to disclose the feature wherein "said panel is joined to said frame in a connection which is significantly enhanced in load-bearing capacity to a connection provided only by the at least one fastener".

CLAIMS 19 AND 20

Claims 19 and 20 recite as follows:

19. An assembly comprising: a support structure;
a panel of light-gauge steel mounted to said support structure;
a structural adhesive curable at room temperature and disposed between said support structure and said panel;
at least one fastener driven through said panel into said support structure,
so that said panel is joined to said structure in a connection which is significantly enhanced in load-bearing capacity in relation to a connection provided only by the at least one fastener.

20. The assembly of claim 19, wherein each said fastener is selected from the group consisting of self drilling screws, rivets, pins and clinches.

Claims 19 and 20 have been rejected as being unpatentable under 35 U.S.C. §103(a) over AAPA in view of Orowan. This rejection should be reversed and the claims be deemed allowable for the reason that there is no proper basis for the proposed combination, and for the reason that none of the references disclose, teach or suggest the feature wherein "said panel is joined to said structure in a connection which is significantly enhanced in load-bearing capacity in relation to a connection provided only by the at least one fastener".

CLAIMS 22 AND 23

Claims 22 and 23 recite as follows:

22. An assembly comprising: a metal support frame;
a panel of light-gauge steel mounted to said support frame;
a structural adhesive curable at room temperature disposed between said support frame and said panel;

a plurality of fasteners driven through said panel into said support frame,

so that said panel is joined to said support structure in a connection which is significantly enhanced in load-bearing capacity in relation to a connection provided only by the at least one fastener.

23. The assembly of claim 22, wherein the fasteners are selected from the group consisting of self-drilling screws, rivets, pins and clinches.

Claims 22 and 23 have been rejected over AAPA in view of Orowan. This rejection should be reversed and the claims be deemed patentable for the reason that there is no proper basis for the proposed combination and the proposed combination fails to disclose, teach or suggest wherein "said panel is joined to said support structure in a connection which is significantly enhanced in load-bearing capacity in relation to a connection provided only by the at least one fastener".

CLAIMS 4-15, 18-21 AND 24

The rejection of claims 4-15, 18-21 and 24 over AAPA in view of Orowan is improper because there is no proper basis for the proposed combination and the proposed combination fails to disclose, teach or suggest *inter alia* "a connection which is significantly enhanced in load bearing capacity in relation to a connection provided only by the at least one fastener." There are additional arguments concerning alternative rejections of these claims as further noted below.

(2) THE REJECTION OF CLAIMS 4-7 UNDER 35 U.S.C. § 103(A) OVER AAPA/OROWAN AS APPLIED TO CLAIM 1 AND FURTHER IN VIEW OF GOOD, ET AL (U.S. PATENT NO. 4,426,425).

A. THE PROPOSED COMBINATION OF AAPA, OROWAN AND GOOD ET AL IS IMPROPER.

The Examiner's contention in combining AAPA/Orowan with Good et al is set forth in paragraph 3 of page of the Final Action as follows:

> AAPA/Orowan discloses a connection system as shown above except for the adhesive being a two-part epoxy system comprising a resin and hardener mixed in equal portion by weight or volume wherein the adhesive fully cures within approximately 72 hours. However, Good et al teaches such adhesive, see column 2, lines 26- 34 and column 3, lines 18-20. Therefore, it would have been obvious to one of ordinary skill in the art at the time when the invention was made, to have used a two-part epoxy system as the adhesive AAPA/Orowan, in light of the teachings of Good et al in order to achieve a bond with a superior shear and strength.

First of all, nowhere in the proposed AAPA/Orowan combination is there any teaching of any epoxy system whatsoever. Moreover, Appellant is unable to find any specific teaching of a two-part epoxy system comprising a resin and hardener mixed in equal proportions by weight or volume as alleged by the Examiner. Furthermore, the Good et al reference merely mentions metal to metal in passing and nowhere suggests the structures as recited in the claims, for example, the connection of light-gauge steel panel to a second member, etc. Moreover, in the teaching of Good, the achievement of a bond with a superior shear and strength is not the superior bond in shear and strength as recited in Appellant's claims, namely, a connection which is "significantly enhanced in load-bearing capacity to connection provided only by the at least one fastener", but is merely allegedly superior in shear and strength to other epoxy systems. Accordingly, when the Examiner's contention is carefully scrutinized, there is no basis for the proposed combination, nor does the combination disclose, teach or suggest all the elements of the claims as contended by the Examiner.

B. SPECIFIC ERRORS OF REJECTIONS OF CLAIMS 4-7.

CLAIMS 4-7

Claims 4-7 recite as follows:

> 4. The connection system of claim 1 wherein said adhesive is a two-part epoxy system.

5. The connection system of claim 4 wherein said epoxy system comprises a resin and hardener which are mixed in substantially equal portions by weight.

6. The epoxy system of claim 4 wherein said epoxy system comprises a resin and hardener which are mixed in substantially equal portions by volume.

7. The connection system of claim 1 wherein said adhesive fully cures within approximately 72 hours.

Claim 4-7 have been rejected as being unpatentable under 35 U.S.C. §103(a) over AAPA/Orowan as applied to claim 1 and further in view of Good et al, U.S. Patent No. 4,426,425 (Good et al). In addition to the reasons advanced for the patentability of claims 1-3, these claims are also patentable for the reason that there is no proper basis for combining the AAPA/Orowan reference with the Good et al reference.

(3) THE REJECTION OF CLAIMS 8-15 UNDER 35 U.S.C. § 103(A) OVER AAPA IN VIEW OF OROWAN AND GOOD, ET AL.

CLAIMS 8-15 RECITE AS FOLLOWS:

8. A connection system for connecting at least one light-gauge steel member to a second member comprising:

applying a bead of epoxy to at least one of said members, said epoxy being curable at room temperature and able to adhere to steel;

positioning said members in adjacent relationship with said epoxy disposed between said members;

driving at least one fastener through one member into said other member; and

allowing said epoxy to cure,

so that said members are joined in a connection which is significantly enhanced in load-bearing capacity to a connection provided only by the at least one fastener.

9. The connection system of claim 8 wherein the fastener is selected from the group consisting of self-drilling screws, rivets, pins, and clinches.

10. The connection system of claim 8 wherein each said fastener is a self-drilling screw.

11. The connection system of claim 8 wherein said epoxy comprises a resin and hardener which are mixed in substantially equal portions by weight.

12. The connection system of claim 8 wherein said epoxy comprises a resin and hardener which are mixed in substantially equal portions by volume.

13. The connection system of claim 8 wherein said adhesive fully cures within approximately 72 hours.

14. The connection system of claim 8 wherein a bead of epoxy is applied to both members.

15. The connection system of claim 1 wherein said adhesive is composed of a material selected from the group consisting of epoxy, methacrylate and urethane.

Claim 8-15 have been rejected as being unpatentable under 35 U.S.C. §103(a) over AAPA/Orowan and further in view of Good et al, U.S. Patent No. 4,426,425 (Good et al). In addition to the reasons advanced for the patentability of claims 1-3, these claims are also patentable for the reason that there is no proper basis for combining the AAPA/Orowan reference with the Good et al reference. Appellant incorporates by reference the arguments presented with respect to section (3) above.

Claims 8-14 are patentable for the reason that none of the references disclose, teach or suggest the "bead of epoxy" as recited in the claims.

(4) THE REJECTION OF 18, 21 AND 24 UNDER 35 U.S.C. §103(A) OVER AAPA/OROWAN AS APPLIED TO CLAIMS 16, 19 AND 22 AND FURTHER IN VIEW OF GOOD, ET AL.

CLAIM 18

Claim 18 recites as follows:

> 18. The connection system of claim 16 wherein the adhesive is selected from the group consisting of epoxy, methacrylate, and urethane.

Claim 18 has been rejected by the Examiner as being unpatentable over AAPA/Orowan as applied to claim 16 and further in view of Good et al. This rejection should be reversed for the reasons previously advanced with respect to claim 16.

CLAIM 21

Claim 21 recites as follows:

> 21. The assembly of claim 19, wherein said adhesive is a two part epoxy system.

Claim 21 has been rejected as being unpatentable under 35 U.S.C. §103(a) over AAPA/Orowan as applied to claim 19 and further in view of Good et al. This rejection should be reversed and the claim be deemed allowable for the reasons advanced for claim 19 and also for the reason that there is no proper basis for the combination proposed by the Examiner.

CLAIM 24

Claim 24 recites as follows:

> 24. The assembly of claim 22, wherein said adhesive is a two part epoxy system.

Claim 24 has been rejected as being unpatentable under 35 U.S.C. §103(a) over AAPA/Orowan as applied to claim 22 and further in view of Good et al. This rejection should be reversed and the claim be deemed allowable for the reason that there is no proper basis for the proposed combination of AAPA/Orowan with Good et al and further, there is no proper basis for the feature wherein "said panel is joined to said support structure in a connection

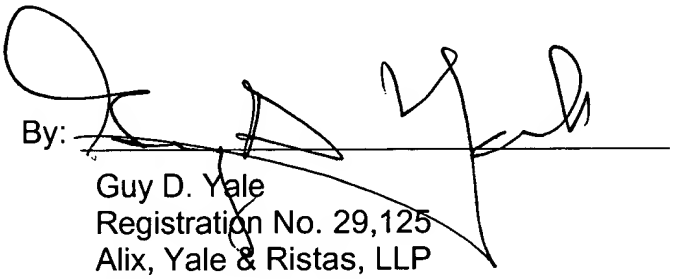
which is significantly enhanced in load-bearing capacity in relation to a connection provided only by the at least one fastener".

VIII. CONCLUSION

There is no proper basis for the Examiner's proposed combination of AAPA and Orowan. There is further no proper basis for the Examiner's proposed combination of AAPA/Orowan and Good et al. Even if the proposed combinations were proper, none of the references individually or in combination properly disclose, teach or suggest all of the features of each of the claims. Accordingly, the rejection under 35 U.S.C. §103(b) of claims 1-24 should be reversed and the claims deemed patentable.

Respectfully Submitted,

Alex S. Toback

By: 

Guy D. Yale
Registration No. 29,125
Alix, Yale & Ristas, LLP
Attorney for Applicant

Date: June 5, 2006
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(860) 527-9211
Our Ref: TOB/102/US

GDY/tlc

IX. APPENDICES

APPENDIX A CLAIMS INVOLVED IN THE APPEAL

1. (previously presented) A connection system for connecting at least one light-gauge steel panel to a support structure comprising:

applying an adhesive to at least one of said panel or support structure, said adhesive being curable at room temperature and able to adhere to steel;

placing said panel against said support structure; and

allowing said adhesive to cure,

so that said panel is joined to said structure in a connection which is significantly enhanced in load-bearing capacity to a connection provided only by the at least one fastener.

2. (previously presented) The connection system of claim 1 wherein the fastener is selected from the group consisting of self-drilling screws, rivets, pins, and clinches.

3. (previously presented) The connection system of claim 1 wherein each said fastener is a self-drilling screw.

4. (previously presented) The connection system of claim 1 wherein said adhesive is a two-part epoxy system.

5. (previously presented) The connection system of claim 4 wherein said epoxy system comprises a resin and hardener which are mixed in substantially equal portions by weight.

6. (previously presented) The epoxy system of claim 4 wherein said epoxy system comprises a resin and hardener which are mixed in substantially equal portions by volume.

7. (previously presented) The connection system of claim 1 wherein said adhesive fully cures within approximately 72 hours.

8. (previously presented): A connection system for connecting at least one light-gauge steel member to a second member comprising:

applying a bead of epoxy to at least one of said members, said epoxy being curable at room temperature and able to adhere to steel;

positioning said members in adjacent relationship with said expoxy disposed between said members;

driving at least one fastener through one member into said other member; and

allowing said epoxy to cure,

so that said members are joined in a connection which is significantly enhanced in load-bearing capacity to a connection provided only by the at least one fastener.

9. (previously presented): The connection system of claim 8 wherein the fastener is selected from the group consisting of self-drilling screws, rivets, pins, and clinches.

10. (previously presented): The connection system of claim 8 wherein each said fastener is a self-drilling screw.

11. (previously presented): The connection system of claim 8 wherein said epoxy comprises a resin and hardener which are mixed in substantially equal portions by weight.

12. (previously presented): The connection system of claim 8 wherein said epoxy comprises a resin and hardener which are mixed in substantially equal portions by volume.

13. (previously presented): The connection system of claim 8 wherein said adhesive fully cures within approximately 72 hours.

14. (previously presented): The connection system of claim 8 wherein a bead of epoxy is applied to both members.

15. (previously presented): The connection system of claim 1 wherein each said adhesive is composed of a material selected from the group consisting of epoxy, methacrylate and urethane.

16. (previously presented): A connection systsem for connecting at least one light-gauge steel panel to a steel frame comprising:

applying a bead of adhesive to at least one of said panel or frame, said adhesive being curable at room temperature and able to adhere to steel;

positioning said panel against said frame with said adhesive disposed between said panel and frame;

driving at least one fastener through said panel into said frame; and

allowing said adhesive to cure,

so that said panel is joined to said frame in a connection which is significantly enhanced in load-bearing capacity to a connection provided only by the at least one fastener.

17. (previously presented): The connection system of claim 16 wherein the fastener is selected from the group consisting of self-drilling screws, rivets, pins, and clinches.

18. (previously presented): The connection system of claim 16 wherein the adhesive is selected from the group consisting of epoxy, methacrylate, and urethane.

19. (previously presented): An assembly comprising; a support structure;

a panel of light-gauge steel mounted to said support structure;

a structural adhesive curable at room temperature and disposed between said support structure and said panel;

at least one fastener driven through said panel into said support structure, so that said panel is joined to said structure in a connection which is significantly enhanced in load-bearing capacity in relation to a connection provided only by the at least one fastener.

20. (previously presented): The assembly of claim 19, wherein each said fastener is selected from the group consisting of self drilling screws, rivets, pins and clinches.

21. (previously presented): The assembly of claim 19, wherein said adhesive is a two part epoxy system.

22. (previously presented): An assembly comprising: a metal support frame;

a panel of light-gauge steel mounted to said support frame;

a structural adhesive curable at room temperature disposed between said support frame and said panel;

a plurality of fasteners driven through said panel into said support frame,

so that said panel is joined to said support structure in a connection which is significantly enhanced in load-bearing capacity in relation to a connection provided only by the at least one fastener.

23. (previously presented): The assembly of claim 22, wherein the fasteners are selected from the group consisting of self-drilling screws, rivets, pins and clinches.

24. (previously presented): The assembly of claim 22, wherein said adhesive is a two part epoxy system.

APPENDIX B DECLARATION OF ALEX S. TOBACK

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	09/639,599
Applicant	:	Alex S. Toback
Filing Date	:	August 16, 2000
Title	:	Connection System for Steel Construction
TC/A.U.	:	3726
Examiner	:	Essama Omgba
Docket No.	:	TOB/102/US
Customer No.	:	002543

Mail Stop Amendment
Commissioner for Patents
United States Patent and
Trademark Office
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

DECLARATION UNDER 37 CFR §1.132

I, Alex S. Toback, hereby declare and state that:

1. I am Technology Consultant to Henkel Corporation of Rocky Hill, Connecticut and I am the named inventor of the above identified U.S. Patent Application.

2. I am presenting this Declaration to establish facts which support the patentability of the pending claims of the above identified application.

3. I have had extensive international, general management, industrial distribution, technical, manufacturing and marketing experience in the specialty chemical and fastener industries. Since 1995 I have been very actively involved in designing fasteners and fastening systems for the light gauge steel industry and in particular fastening systems which are employed in light gauge steel construction for light commercial and residential applications.

4. I have extensive knowledge and background in both the mechanical and the chemical fastening technologies and have used that background and knowledge to address the issue of providing fastening systems for the light gauge steel industry. A true copy of a resume of my educational, managerial and technical career in the specialty chemical and fastener industries is attached to this declaration as Exhibit A.

5. It is very apparent in reviewing the Office Action dated February 8, 2005, and in particular the portion commencing with page 2, paragraph 3 that the rejection of the claims is based on an inaccurate, very incomplete appreciation of the level and knowledge of one of ordinary skill in the light gauge steel construction industry at the time of my invention.

6. As stated in the Patent Specification and as referenced by the Examiner, at the time of the invention of the pending claims 1-24, it was known in the light gauge steel construction technologies to provide a light gauge steel construction and assembly wherein numerous self drilling screws or other fasteners were used to provide a connection between a panel and a support structure (the Examiner refers to the latter as "AAPA"). It was in this context, as President of Metaltite

Corporation, a specialty mechanical fastener corporation, that I turned my attention to the fastening systems for the light gauge steel industry and my original focus in this regard was purely in terms of mechanical fasteners.

7. At the time of my invention of the pending claims of the patent application, a person of ordinary skill in the light steel construction industry was wholly focused on mechanical fasteners and how to provide an improved mechanical fastening system. Until I started to consider addressing the light gauge steel construction fastening systems, there was no thought or suggestion whatsoever in the light gauge steel construction technology of using chemical or adhesive systems in light gauge steel construction. One important factor in assessing the level of ordinary skill and knowledge is that the light gauge steel construction industry typically must comply with building and fire codes in connection with the integrity of the fastening systems, and these codes were and typically now are all based on mechanical fastening systems.

8. Therefore, the statement by the Examiner "Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made, to have used an adhesive material in the connection of AAPA, in light of the teachings of Orowan, in order to relieve the load on fasteners to a relatively small extend and give protection against threading of the parts joined" fails on two grounds. First, there is no objective evidence that it would have been obvious in any way to even attempt to use an adhesive system for light gauge steel construction. Second, the problem addressed was <u>not</u> "to relieve the load on fasteners to a relatively small extent and give protection against fretting between the parts joined." The defined problem which was addressed by the invention of claims 1-

24 of the present application was to provide a fastening system of high integrity which could be implemented in a highly efficient and cost effective manner through improvement of mechanical fasteners and reduction of labor costs since labor is such a significant factor in the cost of the light gauge steel construction. This solution was realized by the use of both mechanical fasteners and the adhesive systems as set forth in the claims 1-24 of the pending application.

9. Contrary to the assertion of the Examiner, there is no evidence that one of ordinary skill in the light steel construction industry would have turned to the Orowan reference. The Orowan reference when carefully examined by one of ordinary skill in the light gauge steel construction industry would be deficient for the following reasons: First of all Orowan focuses on, as acknowledged by the Examiner, a protection against fretting between parts joined. This was not a problem presented in the light gauge steel construction technology at the time of the invention. The present invention is concerned with high strength assemblies which under stress in almost all cases result in failure of steel components rather than the connections. Second, the solution by Orowan proposes a relatively expensive and complex strip of adhesive tape which simply would not be suitable for the application as recited. Third, the Orowan reference does not, considered as a whole, result in a fastening system where the assembly is substantially enhanced in load-bearing capacity compared to that of the mechanical fasteners alone as provided in the assemblies of claims 1-24. Fourth, the passage at col. 1, lines 24-29 does not support the conclusion that "the connection of Orowan is significantly enhanced in load bearing capacity".

10. Contrary to the apparent belief of the Examiner, the invention by the undersigned applicant is not a mere paper concept, but is in fact an invention which has been tested by experts in the light gauge steel construction industry and has great potential as an industry standard. A true copy of a report submitted to the applicant which shows test results on some applications of the applicant's claimed system is attached hereto as Exhibit B.

11. As a result of the invention embraced by the pending claims of the application, I have been contacted by numerous prominent companies and organizations in the light gauge steel industry to discuss the invention and further development of the invention for specific light gauge steel applications. I have been requested to make presentations at industry technical meetings and trade shows. On October 20, 2004 the Light Gauge Steel Engineers Association awarded me a certificate in recognition of outstanding contributions to the advancement of adhesives for the Steel Framing Industry.

I hereby declare that all facts and statements made above are true and accurate to the best of my knowledge and belief and that any opinions are true to the best of my knowledge and belief, and any willful and false statements will jeopardize the validity of any patent issued in the above identified application and may subject me to prosecution under federal law.

Respectfully submitted,

By: _____

Date: May 9, 2005 Alex S. Toback

GDY/tlc

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ALEX S. TOBACK

MECHANICAL/CHEMICAL FASTENING SYSTEMS

Extensive international, general management, industrial distribution, technical, manufacturing and marketing experience in the specialty chemical and fastener industries.

Present President, Toback and Associates

Consultants in the specialty fastener field, combining mechanical and chemical systems that result in high quality, cost effective connections.

1993-1999 President, Metaltite Corporation

A "start up" company that develops and markets specialty fasteners, priced to value, that solve assembly problems. Inventor on one U.S. patent and two provisional patent applications.

1991-1995 President, COO The Eagle Group, Inc.

A 77 year old construction firm specializing in roofing, sheet metal and waterproofing in the commercial market.

1985-1991 Vice President, Industrial Distribution
The Loctite Corporation

Developed and implemented policy, strategy and tactics for Loctite's extensive business through its industrial distributors in the U.S., Canada and Mexico.

Managed and coordinated all aspects of major distributor accounts.

Doubled sales in the industrial distributor channel.

Directed Technical Sales and Industrial Distributor Training.

1984-1985 Vice President
The Loctite Corporation

Developed and implemented the business plan that significantly grew sales in major product line that had exhibited no growth during the previous three years.

1981-1984 Vice President and General Manager
Loctite Brasil Limitada, Sao Paulo, Brasil

Increased sales revenue by 15, 25 and 40% during the three year period despite severe economic conditions and aggressive competition.

Achieved operating profit goals.

Restructured a major part of the organization.

Built and moved into an 86,000 square foot manufacturing facility.

1978-1981 Vice President, Technical
Loctite International

Provided technical expertise on all major international projects in the Far East, Europe and South America.

Provided extensive technical support in the formation of the joint venture with the Peoples Republic of China.

Managed construction of a specialty chemical plant in Mexico, on time and on budget.

Reduced export staff by 25% while maintaining same level of service to our customers.

1963-1978 Loctite Corporation

Held various middle management positions in R&D, Manufacturing, Technical Service and Training. Developed dozens of new products and inventor of four U.S. Patents.

1962-1963 American Cyanamid Company

As a chemist in R&D, solved major production problem in the manufacture of recently acquired technology.

Education

B.S. Chemistry, Central Connecticut State University 1962(Physics minor)
M.S. Chemistry, Central Connecticut State University 1968

Military Service

U.S. Air Force, 1955-1958

Professional Memberships

Society of Automotive Engineers, Adhesive Seminar Chairman – 9 years: Science Engineering Board Member - 8 years.
American Society for Testing and Materials - 16 years.
American Chemical Society - 28 years
Light Gauge Steel Engineers Association - 4 years.

CENTER FOR LIGHT FRAME STRUCTURAL RESEARCH

Department of Civil Engineering
Santa Clara University

COMBINED ADHESIVE-STEEL PIN APPLICATIONS FOR CFS FRAME SHEAR WALLS

Final Report: CLFSR-05-04

May 31, 2004

By

Ioi Lam, Henry Qi and Christopher Pitt (Undergraduate Research Assistants)
Reynaud L. Serrette (Project Director)

Submitted to

Al Toback
Henkel Loctite Corporation
1001 Trout Brook Crossing,
Rocky Hill, CT 06067

"Improving Structural Design Through Innovative Applied Research"

Santa Clara, CA 95053-0563

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Over the past several years, a number of innovative proprietary lateral force resisting elements have been developed for implementation in the light frame residential and commercial construction. These elements are typically used where demands are relatively high and wall space is limited. In designs with low to moderate lateral demands, conventional sheathed walls that utilize mechanical fasteners are often sufficient. To explore the potential benefits, both structural and economical, of structural adhesives in combination with mechanical fasteners in light frame shear wall construction, a joint research effort was initiated in 2002 between the Center for Light Frame Structural Research and the Henkel Loctite Corporation.

The use of adhesives to bond sheathing to light framing is not an entirely new concept. In fact, the 2003 IBC, Section 2305.3.9 (wood frame construction) recognizes the additive strength of adhesives but limits the benefits to wind design and structures in Seismic Design Categories (SDC) A, B and C: *"Adhesive attachment of shear wall sheathing is not permitted as a substitute for mechanical fasteners, and shall not be used in shear wall strength calculations alone, or in combination with mechanical fasteners in Seismic Design Category D, E or F."* Section 2305.3.9 imposes no specific requirements on the properties of the adhesive. In the application presented in this report, the role of the adhesive is primary. The adhesive was developed by chemists at the Henkel Loctite Corporation to provide a dependable structural bond between wood structural panels or sheet steel and cold-formed steel framing members with the expectation that the contribution (number and type) from mechanical fasteners may be reduced. Specifically, this report documents the reversed cyclic performance of 27 mil sheet steel and 7/16-in. OSB rated sheathing (24/16 exposure 1) attached to cold-formed steel (CFS) framing with a structural adhesive and pneumatically driven steel pins produced by Aerosmith Inc..

In the following sections, details of the project scope, test procedures and test results are presented, interpreted and discussed.

SCOPE OF WORK

A series of eight single-sided (sheathing on one side only) cold-formed steel frame shear wall tests were conducted on 2 ft. x 8 ft. and 4 ft. x 8 ft. (out-to-out dimensions) walls. The eight tests comprised four

different shear wall configurations that utilized either a single 27 mil (33 ksi) sheet steel or a single 7/16-in. OSB rated sheathing 24/16 exposure 1 wood structural panels.

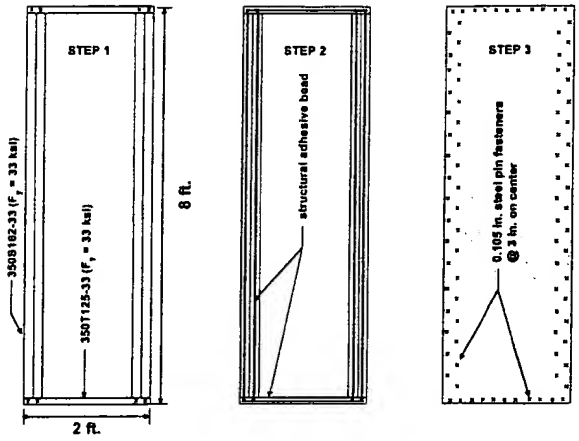
Four of the eight walls were constructed using 27 mil sheet steel. These steel sheathed walls were identical except for their overall dimensions—two walls were 2 ft. x 8 ft. and the other two were 4 ft. x 8 ft. Framing for each wall consisted of 350S162-33 studs at 24 in. on center and 350T125-33 mil top and bottom tracks. The chord studs were back-to-back studs connected with two No. 10 fasteners (transverse to the stud height) at 12 inches on center through the web of the studs. The 27 mil sheet steel was attached to the CFS frame with a bead of structural adhesive on each "contact flange" and Aerosmith 0.105 in. knurled steel pins at 3 in. on center at sheet edges and 12 in. on center in the field. At the chords, the 3 in. on center spacing was achieved with two lines of pins—one line per stud flange—in a staggered configuration. Additional details regarding the configuration of the sheet steel shear walls are given in Table 1 and the sequence of wall construction is illustrated in Figure 1.

The 7/16-in. OSB shear walls were identical (4 ft. x 8 ft.) except for the spacing of mechanical fastener at the panel edges. These walls were framed with 350S162-54 studs at 24 in. on center and 350T125-43 top and bottom tracks. The OSB was attached to the framing with beads of an acrylic structural adhesive on each "contact flange" and Aerosmith 0.105 in. knurled steel pins at either 6 in. or 12 in. on center at the panel edges and at 12 in. on center in the field. The chord studs were back-to-back studs connected with the same structural adhesive used for the sheathing and steel pin at 12 in. on center through the webs. Additional details of the OSB shear walls are given in Table 1 and the sequence of wall construction is illustrated in Figure 1.

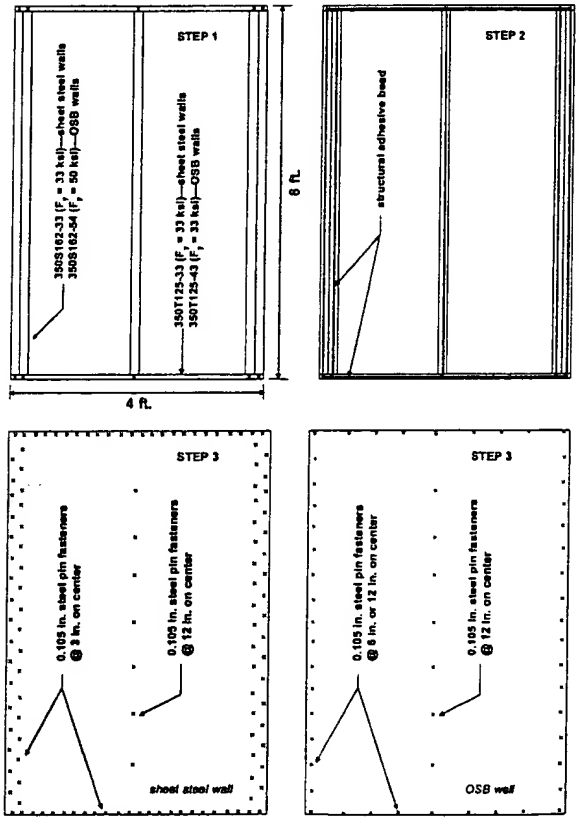
Table 1. Shear wall specimens

Specimen [1,2]	Shear Element	Attachment of Shear Element [3]	Anchorage
2by8-TA 2by8-TB	2 ft. x 8 ft. 27 mil sheet steel (nominal F_y = 33 ksi)	0.105 in. pins at 3 in. on center at the sheet edges and structural adhesive on the contact flange of each framing member	S/HD15 at the chords (back-to-back 350S162-33 studs connected with two No. 10 fasteners at 12 in. on center)
4by8-TA 4by8-TB	4 ft. x 8 ft. 27 mil sheet steel (nominal F_y = 33 ksi)	0.105 in. pins at 3 in. on center at the sheet edges and 12 in. on center in the field; structural adhesive on the attached flange of each framing member	S/HD10 at the chords (back-to-back 350S162-33 studs connected with two No. 10 fasteners at 12 in. on center) and 3/4 in. bolts 12 in. in from each holdown
OSB6-TA OSB6-TB	4 ft. x 8 ft. 7/16-in. (24/16 span rating) OSB rated sheathing	0.105 in. pins at 6 in. on center at the sheet edges and 12 in. on center in the field; structural adhesive on the attached flange of each framing member	S/HD15 at the chords (back-to-back 350S162-54 studs connected with two longitudinal adhesive beads and one steel pins at 12 in. on center) and 3/4 in. bolts 12 in. in from each holdown
OSB12-TA OSB12-TB	Same as above	0.105 in. pins at 12 in. on center at the sheet edges and 12 in. on center in the field; structural adhesive on the attached flange of each framing member	S/HD10 at the chords (back-to-back 350S162-54 studs connected with two longitudinal adhesive beads and one steel pins at 12 in. on center) and 3/4 in. bolts 12 in. in from each holdown

[1] Studs at 24 in. on center
[2] All specimens were 4 ft. x 8 ft. (out-to-out) except 2by8-TA and 2by8-TB which were 2 ft. x 8 ft. (out-to-out)
[3] Nominal adhesive bead width was 0.1875 in.



(a) 2 ft. x 8 ft. walls



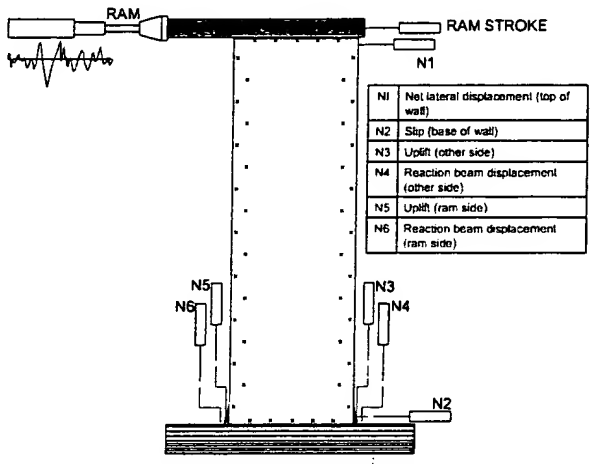
(b) 4 ft. x 8 ft. walls

Figure 1. Wall construction sequence

TEST SETUP/PROCEDURE

Each wall was tested in a horizontal position. The bottom track of the wall was attached directly to a reaction beam with holdowns on each end of the wall and 3/4-in. high strength shear bolts 12 in. in from the holdowns (for the 4 ft. x 8 ft. walls only). No shear bolts were used in the 2 ft. x 8 ft. wall tests. The holdown schedule is given in Table 1. With the bottom of the wall anchored in place, the top of the wall was attached to the load distribution member, through the wall top track, with four 3/4-in. high strength bolts. All attachments of the wall to the test frame were accomplished using a pneumatic wrench.

After a wall was installed in the test frame, displacement transducers were attached to monitor and record the wall performance. The transducers measured and recorded overturning uplift at the bottom of the wall (at each holdown), slip at the bottom of the wall, lateral displacement at the top of the wall and reaction beam displacement (see Figure 2). The resisting load was measured directly by a load cell in line with the load distribution member and the hydraulic ram.



N1	Net lateral displacement (top of wall)
N2	Slip (base of wall)
N3	Uplift (other side)
N4	Reaction beam displacement (other side)
N5	Uplift (ram side)
N6	Reaction beam displacement (ram side)

Figure 2. Instrumentation and test setup

The reversed cyclic test procedure used in this program required cycling a wall through a series of specified increasing top wall displacements/drifts (target displacements) up to 2.8 in.. Target displacements and the corresponding number of cycles at each displacement are given in Table 2. Under the current model codes (IBC, UBC and NFPA), the maximum/allowable inelastic drift for an 8 ft. wall height is limited to 2.4 in.. Thus, per Table 2, the incremental displacement from one target displacement to the next was approximately 8 percent of the model codes inelastic drift limit. During a test, the cycling frequency was held constant at 0.2 Hz (or 5 seconds per cycle), and data was sampled and recorded at a rate of 50 samples per seconds (i.e. one sample every 0.02 seconds).

Table 2. Reversed cyclic test procedure

Target Displacement, in.	No. of Cycles	Target Displacement, in.	No. of Cycles
0.2	3	1.8	3
0.4	3	2.0	3
0.6	3	2.2	3
0.8	3	2.4	3
1.0	3	2.6	3
1.2	3	2.8	3
1.4	3		
1.6	3		

TEST RESULTS

Table 3 summarizes the failure modes, maximum resistances and corresponding lateral displacements/drifts (resistance and displacement are given as the average of the positive (pull) and negative (push) values from the peak response envelope or backbone curves) for the eight wall tests. Figures 3 and 4 show the envelope (backbone) curves derived from the hysteretic response of the sheet steel and OSB walls, respectively. The complete hysteresis response curves are given in Appendix A.

Table 3. Test results

Test No.	General Wall Description [1]	Measured Resistance		Mode of Failure
		Maximum Load [2,3], plf	Total Drift @ Maximum load, in.	
2by8-TA 2by8-TB	2 ft. x 8 ft. wall with 27-mil sheet steel; pins at 3" and adhesive	1165 1207	1.094 1.296	Buckling in the chord (boundary) studs at the web punchout.
4by8-TA 4by8-TB	4 ft. x 8 ft. wall with 27-mil sheet steel; pins at 3"/12" and adhesive	1376 1121	1.092 1.099	Loss of bond between the sheet steel and the adhesive; fastener pullout from the framing.
OSB6-TA OSB6-TB	4 ft. x 8 ft. wall with 7/16-in. OSB; pins at 6"/12" and adhesive	1419 1656	0.699 0.899	In-plane (rolling) shear failure in the OSB; A combination of fastener pullout from the framing, fastener fracture and panel pullover.
OSB12-TA OSB12-TB	4 ft. x 8 ft. wall with 7/16-in. OSB; pins at 12"/12" and adhesive	1200 1532	0.699 0.895	In-plane (rolling) shear failure in the OSB; A combination of fastener pullout from the framing, fastener fracture and panel pullover.

[1] Adhesive applied per Figure 1
[2] Measured resistance in lb. divided by the wall dimension parallel to the applied load
[3] Average of "push" and "pull" resistances

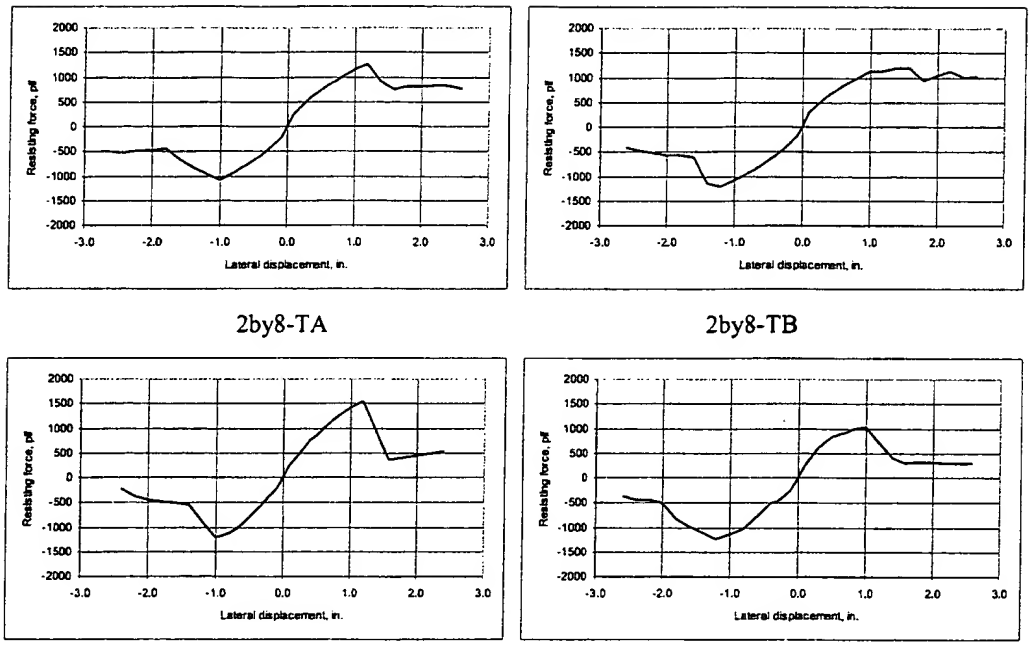


Figure 3. Resistance versus lateral displacement envelope curves for the sheet steel walls

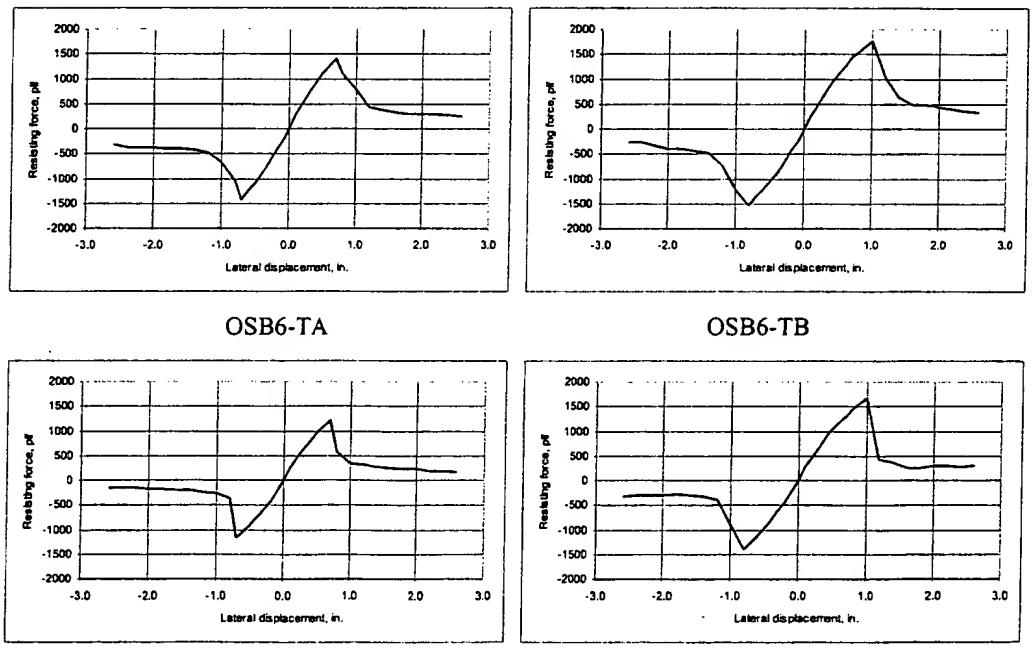
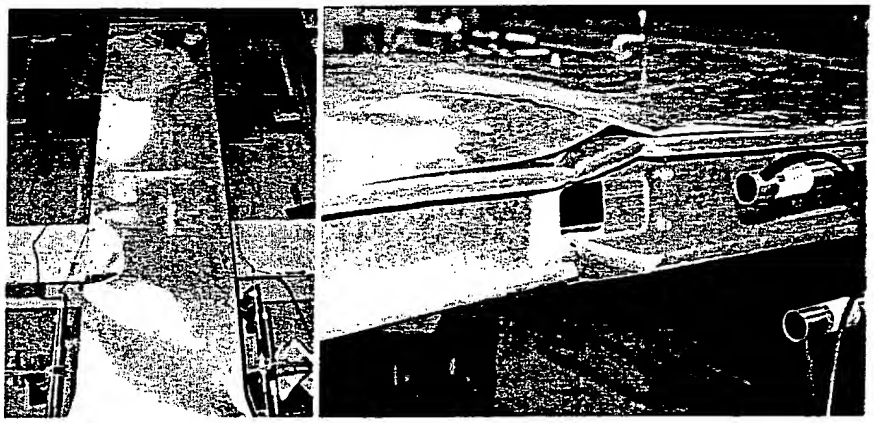


Figure 4. Resistance versus lateral displacement envelope curves for OSB sheathed walls

Sheet Steel Shear Walls: The overall response of the sheet steel walls was characterized by shear buckling and tension field action. In the 4 ft. x 8 ft. walls failure resulted from a loss the bond strength between the structural adhesive and sheet steel as the sheet buckled out of the plane of the wall. This behavior was followed by a progressive pull-out of pins from the framing, including pins at the interior studs. In the 2 ft. x 8 ft. specimens, failure resulted from local buckling in the chord studs at the web punchouts immediately above the holdowns. In this report, failure is defined by a decrease in wall resistance under increased lateral displacement/drift. Figure 5 shows the failure modes for all the sheet steel walls. In one test, 4by8-TA, bending of the top track was observed at one end of the wall. It appears that this behavior resulted from the combined effects of overall twisting of the chord studs, tension field action in the sheet steel and inadequate restraint provided by the round washer used to secure the top track of the wall to the load distribution member, at this end of the wall. When a square washer extending over a larger area of the web track was used, test 4by8-TB, top track bending was eliminated.

OSB Shear Walls: In the OSB walls, failure was observed to result from in-plane (rolling) shear in the structural panel. As shown in Figure 6, the adhesive bonded extremely well to both the steel framing and the OSB. Once bond was lost, a more sudden degradation of wall resistance was observed compared to the sheet steel walls and there was a progressive loss of resistance as a result of pin pullout from the framing, pin fracture and panel pullover.



(a) 2by8 sheet steel walls

(b) 4by8 sheet steel walls

Figure 5. Failure of sheet steel shear walls

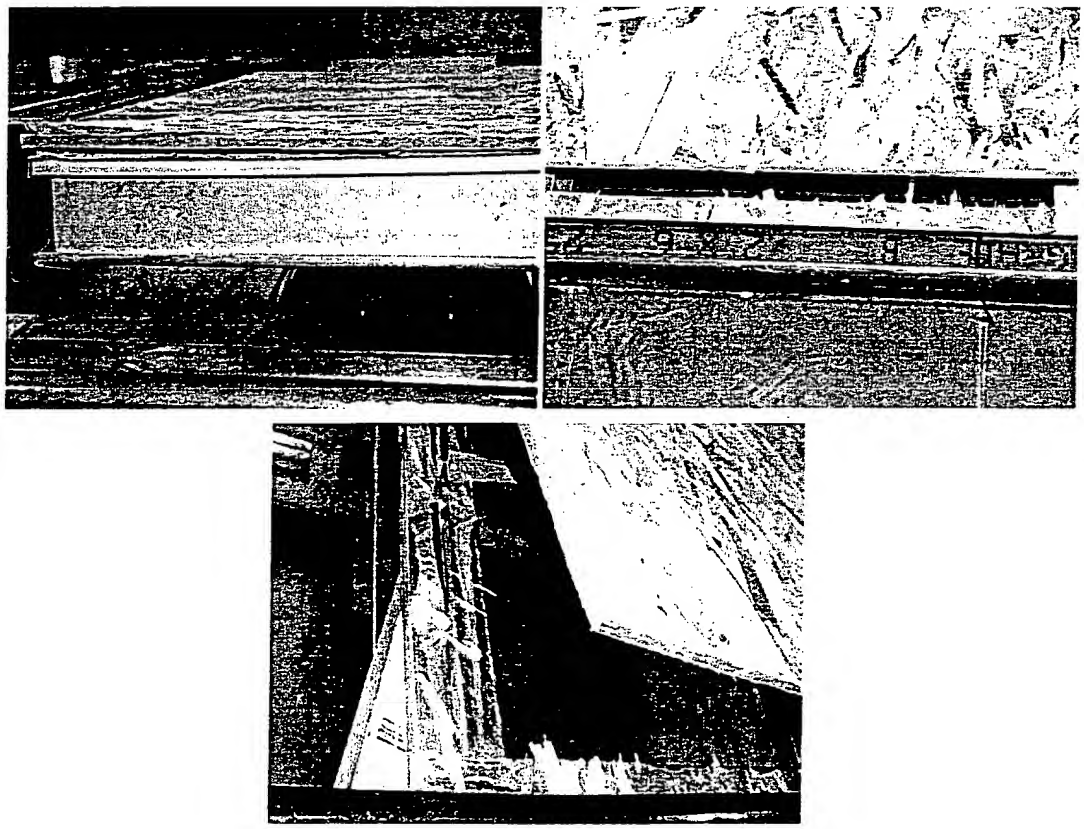


Figure 6. Failure of OSB shear walls

INTERPRETATION and DISCUSSION OF TEST RESULTS

From a design/comparison perspective, one method of interpreting these test results is to use the criteria employed in the development of the seismic design values in the current model codes. In using this approach, it is important to keep in mind the limited number of tests conducted.

The seismic design values for CFS shear walls in the model codes are based on an assumed seismic response modification factor (R) for an expected wall behavior. The recommended design values were then interpreted independent of R. Specifically, the design values in the model codes were developed using a degraded (as opposed to peak) strength envelope as follows:

> The nominal capacity, P_{nom}, of a wall was taken as the lower of the maximum wall resistance, P_{max}, and 2.5 times the wall resistance defined by 0.5 in. of lateral displacement. The LRFD and ASD level capacities were then computed as 0.55 times the nominal capacity and the nominal capacity divided by 2.5, respectively.

Using the above method with the peak (non-degraded) strength envelope (Figures 3 and 4), the nominal, LRFD and ASD level capacities of the tested walls are summarized in Table 4.

Table 4. Interpreted design values

Specimen	P_{nom}, plf	Δ @ P_{nom}, in.	P_{LRFD}, plf	Δ @ P_{LRFD}, in.	P_{ASD}, plf
2by8-TA	*1165*	*1.094*	*641*	*0.433*	
2by8-TB	*1207*	*1.296*	*664*	*0.450*	
2by8 (average)	**1186**	**1.195**	**652**	**0.442**	**474**
4by8-TA	*1376*	*1.092*	*757*	*0.444*	
4by8-TB	*1121*	*1.099*	*616*	*0.396*	
4by8 (average)	**1248**	**1.110**	**686**	**0.420**	**499**
OSB6-TA	*1419*	*0.699*	*781*	*0.338*	
OSB6-TB	*1656*	*0.899*	*911*	*0.402*	
OSB6 (average)	**1537**	**0.799**	**846**	**0.370**	**615**
OSB12-TA	*1200*	*0.699*	*660*	*0.320*	
OSB12-TB	*1532*	*0.895*	*843*	*0.398*	
OSB12 (average)	**1366**	**0.797**	**751**	**0.359**	**546**

Per the data in Table 4, there appears to be no significant difference in capacity of the 2 ft. x 8 ft. and 4 ft. x 8 ft. sheet steel shear walls. Further, given the mode of failure in the 2 ft. x 8 ft. walls, it may be concluded that the capacity of these walls may have been higher if chord stud buckling was prevented (as required by current model codes). When the results for the OSB walls are analyzed, an apparent increase of approximately 12 percent in capacity of the wall is evident for pins are installed at 6 in. on center compared to a wall with pins at 12 in. on center.

A comparison the response curves for the 2 ft. x 8 ft. sheet steel walls in this test program, Figure 3, with the measured peak response of walls where the sheet steel is attached with No. 8 screws only (no structural

adhesive), Figure 7, indicates that use of the adhesive results in a more rapid degradation in resistance after the maximum/peak resistance is attained.

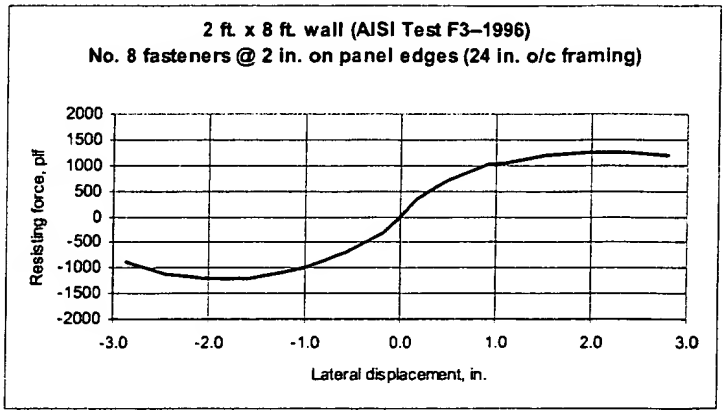


Figure 7. 27-mil 2 ft. x 8 ft. shear wall test from earlier AISI research (Serrette et al. 1997)

A comparison of the 2by8 wall performances (before buckling in the chords) with those of the 4by8 walls (see Figure 8) suggests that the stiffness of the narrower 2by8 walls was roughly the same as the 4by8 walls. One important observation made in the 2by8 tests was the fact fracture of the buckled studs from repeated reversal of load with increasing lateral displacements occurred (6 to 8) cycles after initial stud buckling.

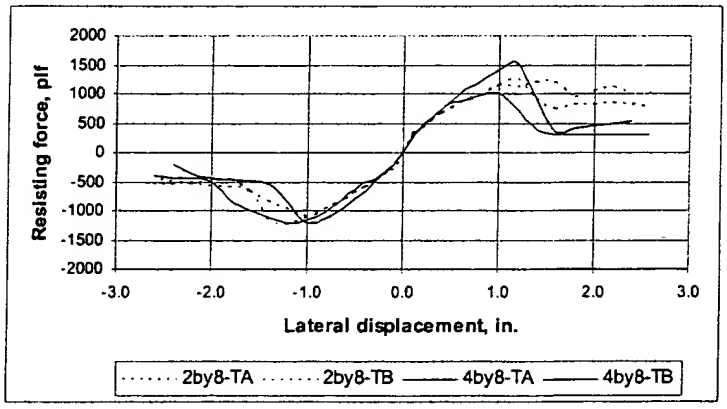


Figure 8. Comparison of sheet steel test results

An inspection of the response curves for the OSB walls indicates that the overall behavior of these walls was essentially linear elastic up to the nominal strength of the wall and there was no difference in wall stiffness for the two pin schedules. Further, although there was a rapid degradation of post-peak resistance, these walls were capable of maintaining a reduced or residual strength in the range of the ASD capacities in Table 4 (at lateral displacements exceeding 1.50 times the displacements at nominal strength). When

evaluating the significance of these residual strength values it is important to note that at both ends of the wall there was a small gap between the structural panel and the test frame that permitted bearing of the sheathing on the reaction frame after the peak resistance was attained.

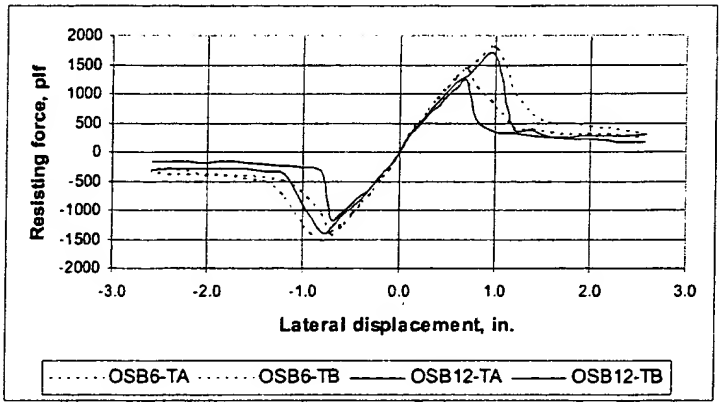


Figure 9. Comparison of OSB test results

Finally, Table 5 compares the recommended design values for these tests (Table 4) with values for similar (not identical) systems, as published in the 2003 IBC. The test to IBC values ranged from 1.04 to 2.20 suggesting that the structural adhesive application with steel pins may be a viable method for developing lateral resistance in cold-formed steel frame shear walls. For seismic design, further refinements to the interpretation of test data may be required given the rapid degradation in post-peak strength seen in these tests. These refinements will be more significant for areas of high seismicity (SDC D, E and F).

Table 5. Comparison of test data with 2003 IBC design values

Test No.	Wall Description	Nominal Resistance, plf		Test/2003 IBC
		2003 IBC [1]	Test	
2by8	Sheet steel sheathed wall with screws fasteners at 3 in. on panel edges	543 [2, 4, 5] (597) [3, 4, 5]	1186	2.18 (1.99)
4by8	Sheet steel sheathed wall with screws fasteners at 3 in. on panel edges and 12 in. in the field	1085 [2, 4] (1194) [3, 4]	1248	1.15 (1.04)
OSB6	OSB sheathed wall with screws fasteners at 6 in. on panel edges and 12 in. in the field	700 [2] (770) [3]	1537	2.20 (2.00)
OSB12	Not permitted in the 2003 IBC	--	1366	---

[1] IBC values are for applications with No. 8 self-drilling screw fasteners

[2] IBC values are based on a degraded strength

[3] IBC values increased 10% (conservatively) for expected peak (non-degraded) resistance

[4] Values interpreted, by linear interpolation, from 2 in./12 in. and 4 in./12 in. fastener schedules

[5] 50% reduction of 2:1 aspect ratio wall value for 4:1 aspect ratio wall

CONCLUSION

A series of eight shear walls (four sheet steel walls: two 2 ft. x 8 ft. walls and two 4 ft. x 8 ft. walls; and four 4 ft. x 8 ft. OSB walls) were tested to evaluate the reversed cyclic performance of cold-formed steel shear walls with structural sheathing attached using a combination of steel pin fasteners and a structural adhesive. Overall, except for the 2 ft. x 8 ft. sheet steel shear walls, the maximum resistances were governed by failure due to a degradation of the bond at the framing-sheathing interface. The 2 ft. x 8 ft. walls failed by buckling in the chord studs at the web punchouts above the holdowns.

The measured resistances exceeded values in the current model codes for similarly sheathed walls (sheathing attached with screw fasteners only). For the OSB walls, the measured responses up to the maximum wall resistances were approximately linear and this behavior was followed by a sudden degradation in strength. The sheet steel walls exhibited a more nonlinear behavior with a less severe reduction in strength after the maximum resistance. Based on these test results, the use of structural adhesives with pneumatically driven steel pins appears promising.

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NFPA, 2003. NFPA 5000 Building Construction and Safety Code, National Fire Protection Association, Quincy, MA,

Serrette, R. et. al., 1997. "Additional Shear Wall Values for Light Weight Steel Framing," Light Gauge Steel Research Group, Research Report No. LGSRG-1-97, Santa Clara, CA, March.

Serrette, R. et. al., 2002. Adhesive Applications for Shear Walls: A Pilot Study, Center for Light Frame Structural Research, Research Report No. CLFSR-12-02, Santa Clara, CA, December.

APPENDIX A

Hysteresis Curves

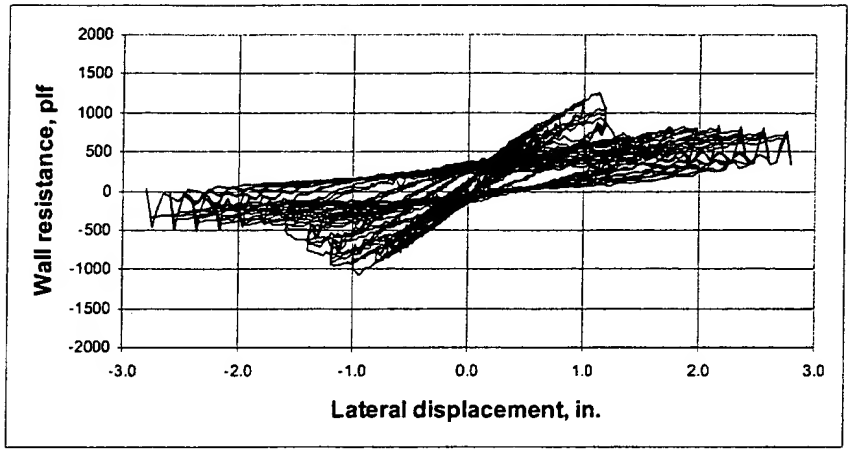

Figure A1. Hysteresis response curve for Test 2by8-TA

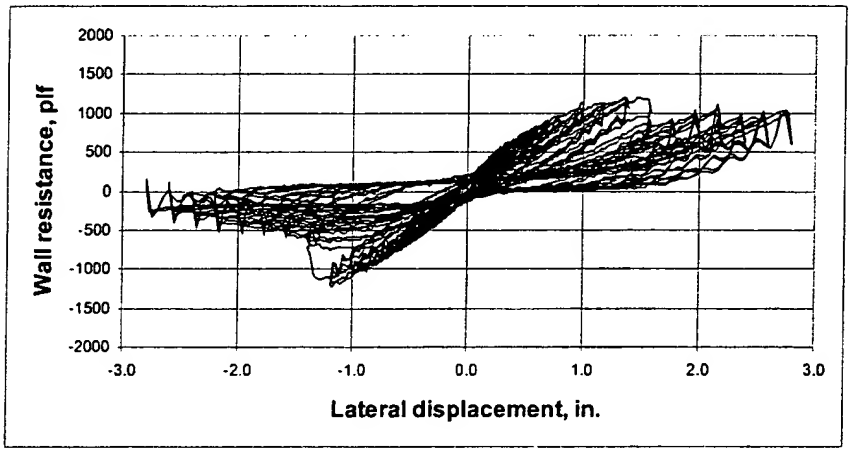

Figure A2. Hysteresis response curve for Test 2by8-TB

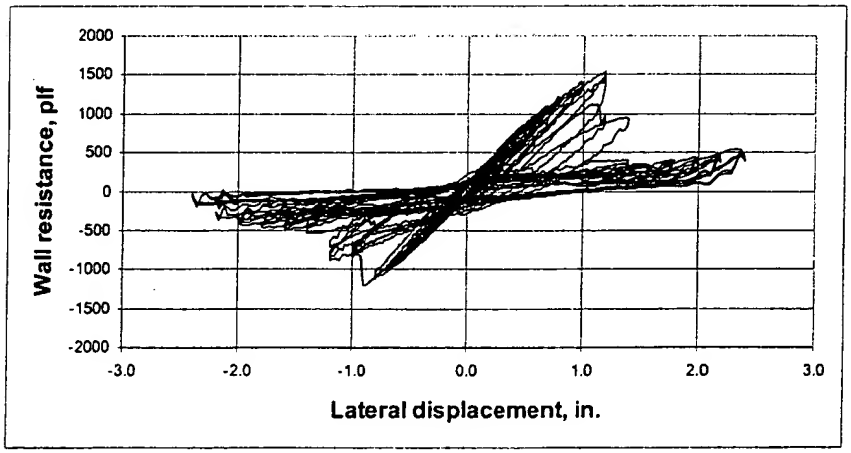

Figure A3. Hysteresis response curve for Test 4by8-TA

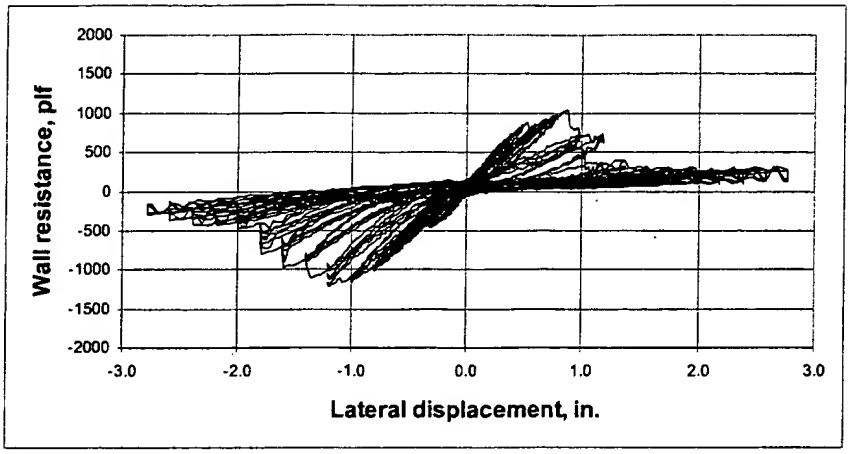

Figure A4. Hysteresis response curve for Test 4by8-TB

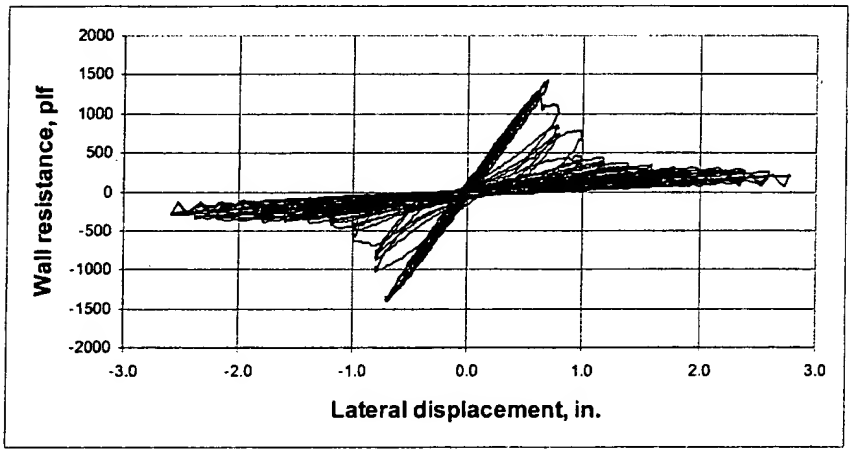

Figure A5. Hysteresis response curve for Test OSB6-TA

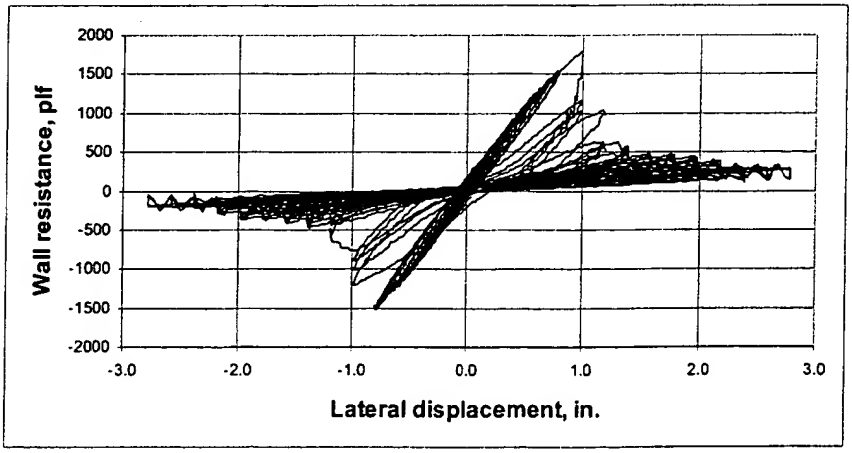

Figure A6. Hysteresis response curve for Test OSB6-TB

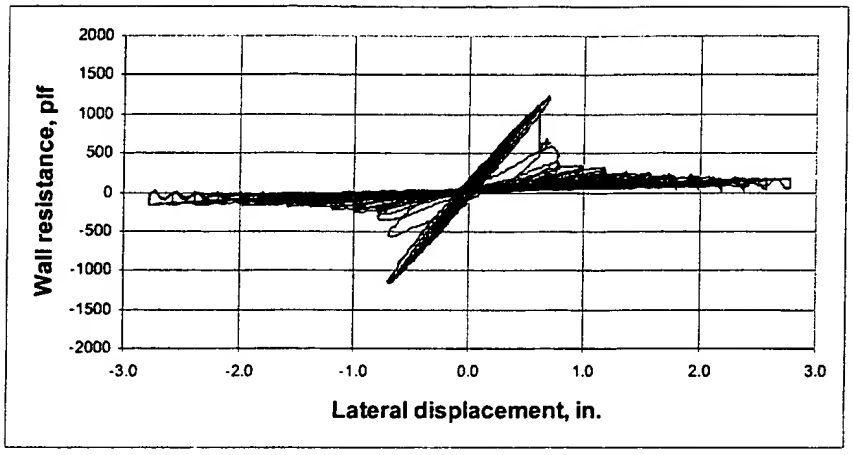

Figure A7. Hysteresis response curve for Test OSB12-TA

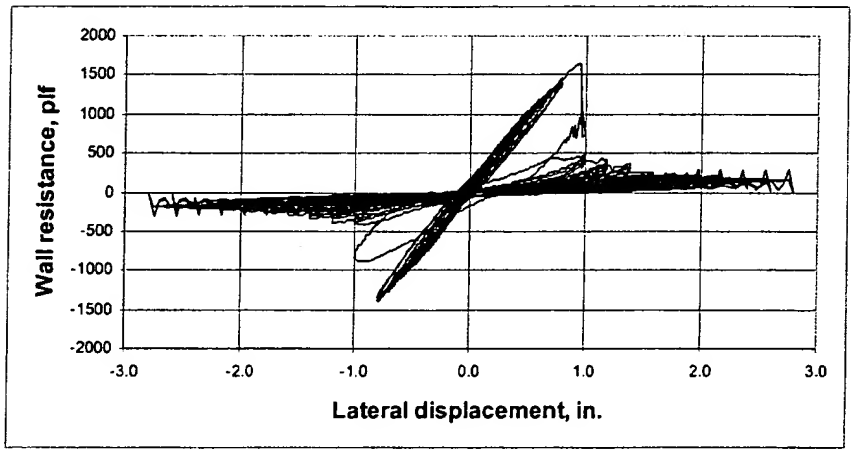

Figure A8. Hysteresis response curve for Test OSB12-TB